

Influence of chemical removal of oxide films, formed by exposure of high-alloy steel to air at high temperatures, on their pitting liability

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Abstract

Corrosion behaviour of high-alloy steels and some similar alloys in electrolytes is essentially impaired by contact with air at high temperatures due to formation of oxide films. Such circumstances exist – at least temporarily – during manufacturing procedures for metallic products, like casting, hot plastic deformation, machining, welding and heat treatment. The presence of oxide films usually increases the liability of high-alloy steels to localised corrosion (especially to pitting) which causes eg castings defects, perforations of thin-wall structures (like pipes and containers) and other serious problems (ecological accidents, explosions etc). This part of investigation is aimed to verify the possibility to avoid harmful consequences of oxide films on high-alloy steels by pickling in mixtures of HNO₃ and HF attending the behaviour in FeCl₃-solution

- on specimens in the state of delivery,
- on specimens previously heated in air, ie with thermal oxides film,
- on previously heated specimens after/removal of thermal oxides in HNO₃/HF mixtures.

For the evaluation of pitting liability topographic criteria have been used and that

- average (\bar{h}) and maximum (h_{\max}) pit depth,
- pits size and their density as well as
- surface area fraction damaged by pitting.

The results are presented in tables and histograms and discussed in detail. It has been concluded that the removal of thermal oxides from surfaces of high-alloy steels reduces essentially their pitting liability in oxidising electrolytes containing chlorides but nevertheless it is recommended to perform subsequent passivation in order to eliminate completely perforations on thin wall structures by „residual“ pits.

Keywords: pitting corrosion, high-alloy steel, oxide film

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